that the incrustation (on the surface of plants) has been formed by the evaporation of water holding the salt in solution, which had been excreted by the plant;" while on page 60 it is said that "there is no evidence to prove that a plant loses any of its mineral substances which it absorbs." In the table on page 106 the relative numbers of stomata upon the two surfaces of the leaf of the Lilac (*Syringa vulgaris*) are given as 100 for the upper, 150 for the lower surface, an error which is the more notable from the fact that the figures in the following column ("relative quantity of water transpired") lose their significance when brought into relation with the proper numbers (0 for the upper, 330 per square mm. of the lower surface).

On page 599 we notice with pain the careless use of the word "bud," in speaking of the soredia of lichens. The use of words in this loose way in a scientific work can be productive of bad results only. A bud is one thing, a soredium is an entirely different thing. On pp. 602 and 603 we find another batch of loose statements, from the description of the mode of spore-formation in Bacillus to the remark that "the teleutospores of these fungi [Uredineæ] are those which are formed in the autumn, at the close of the growing season."

In spite of these blemishes and imperfections, the book is one calculated to do much to elevate the botanical work of the schools and colleges, and we trust that in this country its spirit and influence may be abundantly felt.—*Charles E. Bessey.*

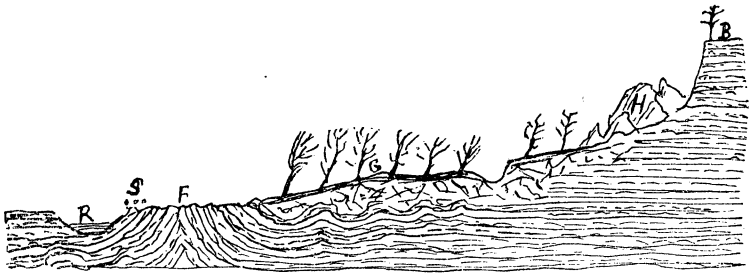
GENERAL NOTES.

GEOLOGY AND PALÆONTOLOGY.

A Landslide at Brantford, Ontario, illustrating the Effects of Thrusts upon Yielding Strata.—A landslide along the right bluff of the Grand River, about two miles southeast of Brantford, Ontario, which occurred at 6.45 P.M. of April 15, 1884, is worthy of notice as giving not only one of the best known illustrations of the structure of the Erie Clay of Ontario, but as showing the physical effects upon a smaller scale of lateral thrusts upon yielding strata.

At the point where the slide occurred the valley is about two miles wide, although some distance above and below it is much narrower. The sides of the valley rise about ninety feet above the flood plain, which is ten feet above the usual surface of the river. The upper twenty feet are composed of sandy Saugeen Clay (of Canadian geologists), in very thin regular beds, whilst the lower portion of the cliffs and that below the modern alluvium

consists of Erie Clay. None of the underlying rocks of the Upper Silurian series are exposed. Owing to weathering, the surfaces of the Erie Clay soon cease to show their stratification. But here, after the slide, the great hummocks and pyramids—some ten feet or more in height, with bases as great or greater—have been bodily thrown out in great quantities, owing to the finely-jointed structure rarely shown in natural sections or artificial cuttings. The joints are mostly oblique to the bedding, yet some are perpendicular. These pyramids are composed of indurated beds of fine clay in layers of only an inch or two in thickness, easily splitting into slabs. The landslide, in this material, extended along the face of the bluff for seven hundred feet. A belt, eighty feet wide, was detached from the brow of the table-topped cliff, and in sinking sixty feet, caused the forward movement of a mass two hundred and forty feet wide, and anywhere from twenty-five to forty feet thick, between the lower part of the hill-side and the river, as shown in the diagram, which is across the western end of the slide.



R, bed of river; S, stones lifted by thrusts from bed of river; F, folds produced; G, grassy slope moved forward; H, hummocks from the face of the bluffs, B. Scale, one hundred feet to one inch.

Owing to the forward movement and reaction, the deposits of the Erie Clay have been raised into perfectly truncated anticlinal folds, which are composed of vertical strata more or less twisted. The vertical edges, where not concealed, are forty-four feet across, and on them—ten feet above the surface of the river—are resting the pebbles of the former bed of the stream now elevated.

Adjacent to the vertical strata at the western end of the slide rest the transported, but otherwise almost undisturbed, grassy sloping surface, with the trees still standing, but sloping at angles from twenty-eight to thirty-five degrees from the perpendicular towards the hill, as the present slope is that of a surface which formerly stood farther up the hill-side, at a higher angle. The junction of the former steeper and lower inclinations is now marked across the transported grassy surface by a deep longitudinal fissure. The eastern end of the slide consists only of a confused mass of hummocks and pyramids.

The landslide was due not to any undermining of the bluff, as the inclination of its lower part was at too low an angle, and the river two or three hundred feet away, but due to the hydrostatic pressure acting in the joints and along the smooth bedding of the clay, wherein the cohesion was reduced so as to allow the sinking of the brow of the bluff, and pushing forward a mass whose total volume was from half a million to a million cubic feet.

This landslide might almost be regarded as a gigantic laboratory experiment on plications, twistings, and thrusts, as shown in folded schistose rocks of mountain regions.—*J. W. Spencer, University of Missouri, Columbia, Mo.*

Age of the Niagara River.—The visit in August last of the Geological Section of the American Association to St. David's Valley,—adjacent to the Whirlpool of the Niagara River,—has drawn forth some notes upon this subject in the issues of *Science* for September 3 and 10, 1886.

In my various articles bearing upon the origin of the Great Lakes,—the most recent of which appeared in "Surface Geology of the Region about the Western End of Lake Ontario," *Canadian Naturalist*, 1882,—after having shown that the deep western end of Lake Ontario was due to subaerial erosion and streams,—among which was a great river flowing from the Erie Basin, with large tributaries from the highlands of the province of Ontario, cutting a cañon through the thick beds of limestones and shales of the Niagara escarpment to a depth of nearly one thousand feet—now partly submerged beneath Lake Ontario—and a width of over two miles,—I accounted for the drift-filled valley of St. David as being a portion of a channel of an interglacial Niagara River.

Subsequent observations of Dr. Julius Pohlmann (Proc. A. A. A. S., 1882) show that the eastern end of the Erie Basin is due to erosion by streams,—some of whose channels are now deeply buried near Buffalo,—which emptied into the Alleghany River, as it flowed northward from near Dunkirk, into the western end of Lake Ontario by the Dundas Valley. This great ancient water-way is now partly filled with drift, and is still more obscured by the warping of the rocks along the anticlinal between the two Great Lakes.

Upon further examination it will be found that the St. David's Valley is small, not only when compared with the great (Dundas) valley,—the old outlet of the Erie Basin,—but even with many other valleys cutting into the Niagara escarpment. Again, Professor Claypole's observation that rocks are found beneath the talus at a considerable height along the sides (at least) of the buried valley at the Whirlpool, restricts still more its probable depth. In short, the St. David's Valley is inadequate for the drainage of a great basin like that of Lake Erie.

Not even was the ancient representative of the upper portion of the Niagara River, above the Falls, of sufficient depth to drain Dr. Pohlmann's Buffalo Creek, for it flowed in a channel at least eighty-three feet beneath the present surface of Lake Erie, whilst the adjacent ice-scratched bed of the Niagara River, at the Buffalo International Bridge, is not more than forty-five feet beneath the lake surface.

Consequently, it appears that the St. David's Valley and such portions of the channel as those ice-scratched above the Whirlpool which remain, represent only the water-course or water-courses of local drainage before the Ice Age. This being the case, the ancient river did not recede deeply into the Niagara escarpment, and we are led to the conclusion that the cañon of the Niagara River, above the Whirlpool as below, is mostly of modern origin throughout, and not to any great extent an ancient drift-filled gorge, re-excavated since the Ice Age.—*J. W. Spencer, University of Missouri*, November, 1886.

Palæontological Observations on the Taconic Limestones of Canaan, Columbia County, N. Y.[1]—These researches occupied a little more than two days in June of this year, and were made in continuation of those previously reported, with the following results:

I. Thorough search was made in and around the farm of E. S. Hall, near Flatbrook, with the hope of finding in place the Trenton limestone which occurs here in large loose angular masses, filled with *Solenopora* (*Chætetes*) *compacta* and other minute corals. A ledge was found which may very likely contain altered nodules of this coral, but no positive evidence of its presence was obtained. The fossiliferous masses may well have come from ledges concealed under the deep drift which covers this farm.

II. An exceedingly interesting locality of richly fossiliferous limestone was discovered about two and a half miles to the north of Hall's farm. It is on the farm of Mr. Joseph Heminway, about a mile and a quarter northeasterly from the Canaan Four Corners Railway Station; it barely crops out at the surface, at the eastern foot of a very conspicuous limestone ledge lying immediately east of the farm buildings. Much of this rock is a mass of organic remains, most of which are finely comminuted fragments of crinoid columns mixed with portions of mollusc shells.

Though presenting a somewhat different set of the larger organisms, this stratum appears most probably identical with the fossiliferous limestone at the Canaan railroad tunnel, described in the *American Journal of Science* for April, 1886. The Hem-

[1] Abstract of paper presented before the American Association for the Advancement of Science, at Buffalo, August, 1886.

inway outcrop is, however, much the richer in fossils, of which the following have already been collected:

1. Crinoidal fragments in vast numbers.

2. Fragments of lamellibranchs, perhaps of the genus Lyrodesma.

3. Gasteropods of several genera and species. One of these is apparently a Holopea. Two or three other species which are very conspicuous on weathered surfaces have low spires and numerous whorls; some of these are from one to two inches in diameter, and have six or seven whorls. They look exceedingly like Ophileta, but may prove on careful examination to be Helicotoma or Pleurotomaria.

4. A single genal spine of a small trilobite.

There were found also, large calcareous plates, whose precise nature is not evident.

The general character of these organic remains indicates very decidedly the post-Cambrian origin of the strata; while, in spite of the Ophileta-like appearance of some of the Gasteropods, the presumption is strong that they belong to the Trenton epoch.

NOTE.—Subsequently to the presentation of the above paper, the continuation of these investigations at Canaan developed yet more important facts. In a limestone ledge on the Heminway farm, lying a little east of the fossiliferous outcrop above described, indications of Orthocerata were noticed; on following this outcrop northward a few hundred feet into the farm owned by Professor Charles Drown, quite a number of very interesting Orthocerata were discovered. These are finely preserved and distinctly characterized, showing admirably the septa and siphons. One of these is very nearly one foot long, and its shell is quite cylindrical, since the taper is exceedingly gentle. The septa in all are quite frequent, about fifteen to twenty to the inch. A well defined lituite was also found here.

These Orthoceratites are of the same general type as those occurring at Rockdale, near Poughkeepsie, N. Y., which from their character, and from their associate fossils, I consider as belonging to the horizon at present known as the Calciferous.

This, and the Trenton, therefore, appear to be associate components of the Canaan limestones.—*Wm. B. Dwight.*

MINERALOGY AND PETROGRAPHY.[1]

Volcanic Bombs.—In view of the fact that the volcanic bombs of Monte Somma present such a large variety of beautifully crystallized minerals in druses, and further, that in the case of the limestone bombs these minerals may well be supposed to owe their origin to the action of the hot lavas on pieces of limestone torn from the walls of the vent through which the lavas reached

[1] Edited by DR. W. S. BAYLEY, Madison, Wis.